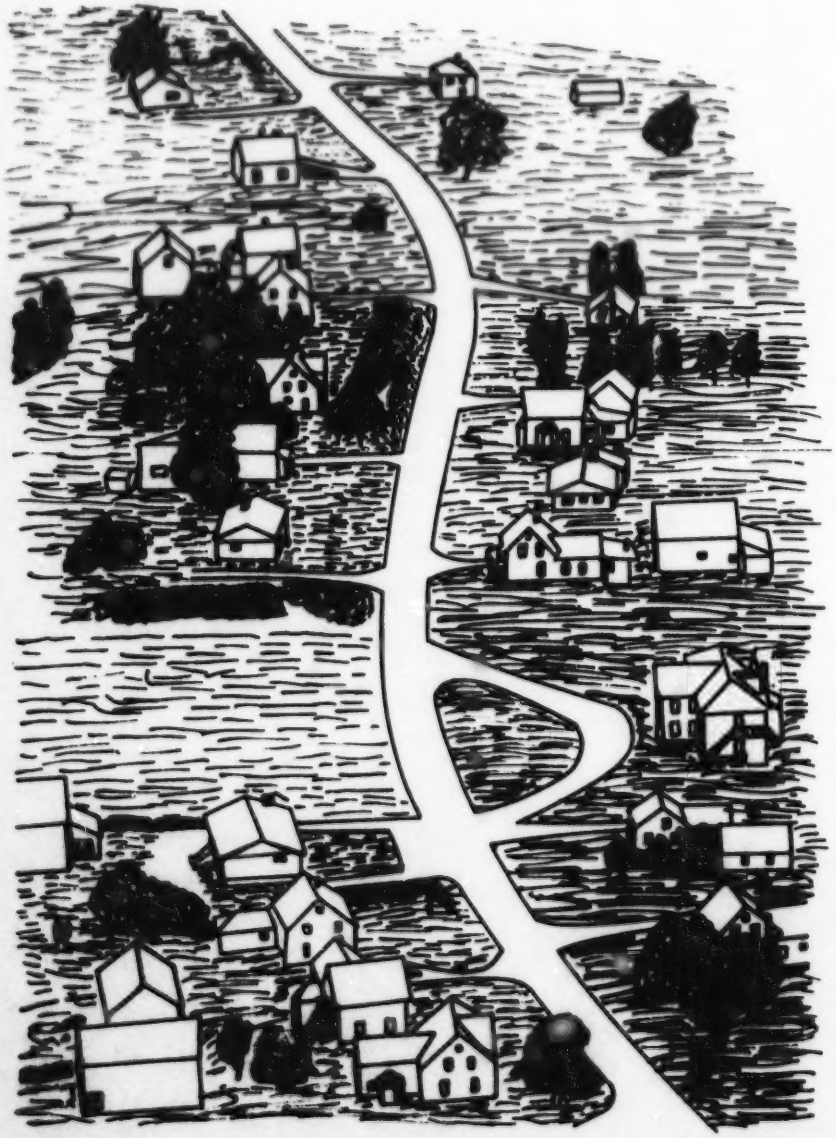
# WASTEWATER MANAGEMENT DISTRICTS



## An Alternative For Sewage Disposal In Small Communities

Nova Scotia

# WASTEWATER MANAGEMENT DISTRICTS

## An Alternative For Sewage Disposal In Small Communities

This information booklet has been prepared jointly by the Nova Scotia Departments of Municipal Affairs, Health and Environment.

Publication Date: May 1983

# FORWARD

The Nova Scotia Department of Municipal Affairs, in conjunction with the Provincial Departments of Health and Environment, takes pleasure in issuing this booklet entitled "Wastewater Management Districts". It is our hope that the material contained herein will generate a wider interest in seeking flexible, cost-effective and reliable sewage disposal systems for the less densely developed areas of our Province.

# TABLE OF CONTENTS


SUMMARY . . . . . S-1

1. INTRODUCTION . . . . . 1

2. THE WASTEWATER MANAGEMENT DISTRICT CONCEPT . . . . . 4

3. APPLYING THE WASTEWATER MANAGEMENT DISTRICT CONCEPT . . . . . 6

4. THE TECHNOLOGY . . . . . 9
   4.1 Collection . . . . . 10
   4.2 Treatment . . . . . 12

5. COST IMPLICATIONS . . . . . 17

6. A PILOT PROJECT . . . . . 20

7. FURTHER INFORMATION AND ASSISTANCE . . . . . 21

APPENDIX 1 - Excerpt from Municipal Act as amended June 1982 . . . A-1

# SUMMARY

In many communities where on-site sewage disposal systems have created pollution problems and health hazards, the automatic response has been a demand that central sewers be installed. In many instances this demand has been met, despite a recognition that the responsibility for the pollution problem could be traced to a relatively small number of domestic sewage sources within the community (usually malfunctioning private septic tank/disposal field systems). Indeed, in many communities throughout Nova Scotia where central sewer systems have been installed, home owners have been obliged to "hook-up" to the system, regardless of whether or not they possessed a properly functioning on-site disposal system. The primary reason for this requirement was that no guarantee could be given that such a system, if improperly maintained , would not become a pollution source at some point in the future.

Recent research has shown that in a majority of cases where private septic tank disposal systems have failed to provide satisfactory service, failure can be attributed to improper installation and maintenance. A widespread misconception that the device was technically inadequate often covers up the real reason for system failure - improper maintenance or, in some cases, faulty installation.

There are a number of options available for ensuring that private sewage disposal systems are properly operated and maintained. Experience in other communities throughout North America has shown, however, that one of the most effective management entities for non-central systems has been a public agency.

In Nova Scotia, legislation has recently been passed which permits the creation of a municipally owned and operated utility to manage all wastewater disposal systems within a designated area (referred to as a Wastewater Management District), whether they are privately or publicly owned.

The procedure that must be followed in order to apply the Wastewater Management District concept to a specific problem area includes the following steps:

1. A thorough site investigation;

2. Identification of the specific geographic area to be included within the Wastewater Management District;

3. Selection of the most appropriate wastewater disposal system(s);

4. Preparation of accurate cost estimates;

5. Receipt of approval from ratepayers within the proposed District for the creation of the Wastewater Management District;

6. The preparation and adoption by Municipal Council of a municipal by-law establishing the Wastewater Management District; and

7. The adoption of a management strategy.

A variety of options are available in the selection of the most appropriate wastewater collection, treatment and disposal strategy for a particular area. However, in any given application, it is reasonable to expect that a number of homes (and/or businesses) will be serviced by individual on-site septic tank/soil disposal systems, while others may be grouped (clustered) into common off-site systems.

The application of the Wastewater Management District concept, versus the installation of a conventional central sewer system, can result in substantial cost savings. A pilot project recently completed in the Yarmouth County community of Port Maitland has demonstrated that a cost reduction in the order of 50% is achievable.

It is anticipated that this booklet will be of interest to those small to medium sized municipalities in which domestic pollution problems have been identified and possible solutions are being investigated.

# 1. INTRODUCTION

The disposal of human waste in an environmentally acceptable and cost effective manner has been a problem throughout history. In many communities where pollution problems have become apparent, the automatic reaction of the community has been, "We need sewers!" During the 1960's, many provincial governments undertook programs to promote equal opportunity for rural areas of our country. The Province of Nova Scotia, with substantial assistance from the Federal Government, was able to offer high-ratio cost sharing programs to many rural municipalities. The availability of such assistance made it feasible for smaller communities to undertake sewerage projects based on proven technology associated with central sewage collection and treatment systems common to urban areas.

A number of developments in recent years, however, has necessitated a re-thinking of the idea that central sewerage systems are the only solution to pollution problems in the urban-fringe and rural areas of Nova Scotia.

Firstly, the costs associated with the installation and maintenance of central sewerage systems have, in recent years, escalated at a very rapid rate. Over the past 13 years, the average cost per connection of installing central sewerage systems in Nova Scotia has risen six-fold: from $1,500 per connection in 1969 to approximately $9,000 per connection in 1982.

Operating and maintenance costs of central sewerage systems, partially due to high electrical input requirements, have escalated at a similar pace. In many instances, a lack of experienced personnel required to operate and maintain central sewerage systems has resulted in premature failure, adding further to municipal sewage disposal costs.

Secondly, improper operation and maintenance have resulted in substandard performance of many sewage treatment plants throughout the Province. The net effect of this situation is that isolated pollution problems prevalent prior to servicing have been collected and one large problem has been created.

Thirdly, changes in Provincial grant programs and the cancellation of the Canada Mortgage and Housing Corporation's Community Services Contribution Program in 1980 virtually eliminated the availability of high-ratio cost-sharing from senior levels of government.

Fourthly, extensive research into the field of septic tank/soil absorption technology has shown that in a large percentage of instances where these systems have failed to provide satisfactory service, improper installation and/or maintenance can be cited as the reason for such failure. Had these systems been installed and maintained properly (regular pump-out, inspection and upgrading),

failure could have been avoided. Recent changes to the Municipal and Towns Acts have enabled the creation of a publicly owned and operated utility to manage privately owned on-site sewage disposal systems within a designated geographical area called a Wastewater Management District (WMD).

The preceding developments have made it both necessary and possible for municipal governments to seek and develop low cost, flexible alternatives to the conventional central sewerage system. This document will be of benefit to those wishing to do so.

# 2. THE WASTEWATER MANAGEMENT DISTRICT CONCEPT

A Wastewater Management District is similar in many respects to a Sewer District, with one major exception. The legislation enabling the creation of a WMD (see Appendix 1) permits a municipality, following public approval by the ratepayers in the proposed District, to enter private properties within the District for purposes of inspecting, repairing, upgrading, or replacing wastewater systems (usually septic tank/soil absorption systems).

Note that, as in the case of a Sewer District, all property owners within a WMD are obliged to participate in the funding of the system. All ratepayers within the WMD must pay an annual charge which is applied to capital recovery as well as annual operation and maintenance costs associated with wastewater disposal within the District.

There are a number of institutional alternatives for the public management of a WMD. In Nova Scotia these would include:

1. a sewer committee of municipal council;
2. a public works committee of municipal council.

The primary functions of the chosen management entity may include any or all of the following, depending on the wishes of the municipal council:

- own, purchase, lease and rent both real and personal property;
- plan, design, construct, inspect, operate, and maintain all types of wastewater disposal systems located within a WMD (this includes regular pump-out services for privately owned septic tanks);
- enter into contracts, undertake debt obligations either by borrowing and/or issuing bonds;
- fix and collect charges for sewerage usage;
- plan and control how and at what time service will be extended;
- make rules and regulations regarding proper sanitation and the use of on-site disposal systems, to issue orders against violations, be empowered to repair or replace malfunctioning systems.

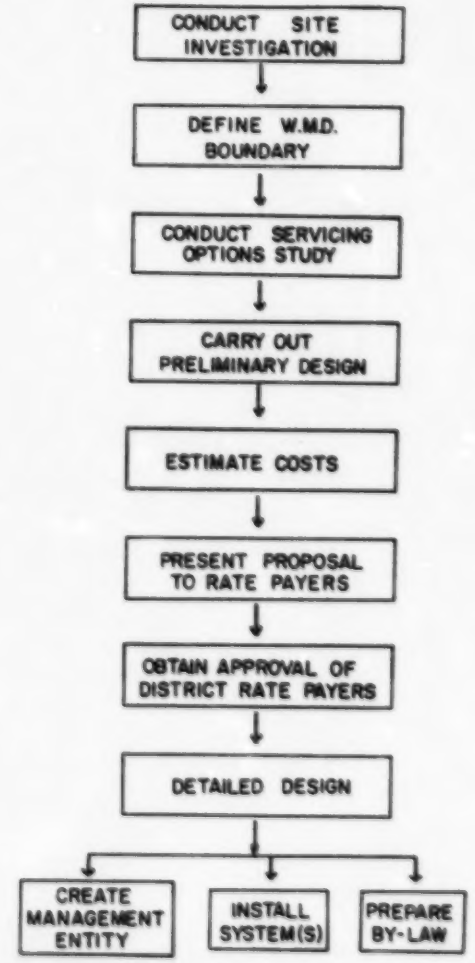
In many instances, it is expected that the preceding responsibilities can be assumed by staff of the Municipal Clerk's office and Municipal Works Department.

# 3. APPLYING THE WASTEWATER MANAGEMENT DISTRICT CONCEPT

The process of establishing a Wastewater Management District within a community must begin with a thorough site investigation. The considerations for site investigation include analysis of a wide range of factors which include, among other things:

1. the performance of existing disposal systems;
2. soil type, texture and depth to bedrock;
3. depth to seasonal high water table;
4. projected wastewater flows.

If a Wastewater Management District is found to be technically feasible, the next step involves the delineation of the geographic area within which the Wastewater Management concept is to apply. It is not imperative that the boundary of a WMD coincide with an existing jurisdictional boundary, although this may be desirable for purposes of administrative simplicity. In practice, WMD's are typically limited to small portions of municipalities where pollution problems are most extreme.




PROCEDURE FOR ESTABLISHING A W.M.D.

At this point in the process, a Servicing Options study must be carried out. This study should indicate the type of sewage disposal system(s) most appropriate for the proposed WMD. The following chapter of this booklet identifies some of the technology options available.

Based on the findings of the Servicing Options study, a preliminary design will then be carried out. This preliminary design should be detailed enough to permit an accurate estimation of the costs associated with the proposed undertaking.

At this point, it is necessary to seek the approval of the residents within the affected area for the formal establishment of the Wastewater Management District. Under the recently approved legislation, a municipal or town council has two options for seeking such approval:

1. By conducting a secret ballot at a public meeting of the persons assessed within the proposed WMD for real property tax. Provided a <u>majority vote</u> is received, and that the property assessment of that majority represents at least <u>fifty</u> percent of the total real property assessment within the proposed district, a Wastewater Management District may be established.

or

2. By conducting a plebiscite of eligible voters in accordance with the Municipal Elections Act.

Once approval has been received the municipality may proceed with the detailed design and installation of the proposed wastewater disposal system(s). The creation of an appropriate management entity may proceed concurrent with system installation.

The authority for a municipality to assume the responsibility for managing all sanitary sewage disposal within a Wastewater Management District must be contained in a municipal bylaw which shall:

(a) delineate the boundaries of the WMD;
(b) state the system or systems of wastewater management to be used in the District;
(c) state the extent to which the municipality assumes responsibility for the repair, upgrading, or replacement of private and public sewer systems;
(d) provide a method for charging the persons assessed for real property tax within the District the expenditures made in the district for any wastewater management system;

This bylaw must be in place prior to system utilization.

# 4. THE TECHNOLOGY

Traditionally, when central sewerage systems have been installed in a particular community, it has been a requirement that all sources of sanitary sewage be connected to the new system regardless of whether or not they were being handled in an acceptable fashion prior to servicing. In many instances, recent investments in properly functioning septic tank/soil absorption field systems were wasted. This stipulation was, nonetheless, deemed necessary in order to guarantee that a long term solution to sanitary sewage disposal would not be jeopardized by potential future malfunctions of private disposal systems. Furthermore, this policy ensured that the costs associated with the installation and operation of a central system would be shared by a maximum number of ratepayers, thereby minimizing the cost per connection.

The WMD legislation, by enabling the municipality to operate and maintain <u>all</u> wastewater disposal systems within a given area (both public and private), offers the municipality a greater degree of flexibility in choosing the system or combination of systems most suitable for any given area. The technology choice goes beyond the on-site <u>or</u> central serving proposition of past years, now that proper operation and maintenance can be ensured for <u>all</u> systems.

In order to provide a simplified view of existing technology, sanitary sewage disposal can be viewed from two perspectives, collection and treatment.

## 4.1 COLLECTION

As the collection system for sewage typically represents over two-thirds of the total system cost, it can affect the local community from a cost viewpoint more than other components of the project. There is, therefore, considerable incentive to choose less expensive alternatives to conventional collection systems.

Generally, the following are considered as alternatives:

- pressure sewers;
- small diameter sewers;
- vacuum sewers.

These systems basically attempt to overcome the inherent disadvantage of conventional gravity sewers through elimination of the need for constant slopes on the collection pipe and consequent deep excavation in hilly and wet terrain or where bedrock is close to the ground surface. In addition, the need for costly large scale pumping stations and pressurized mains can be reduced or eliminated.

The need for extensive collection systems can be reduced if the sewage can be disposed of close to the source. The principle is well illustrated by the lower costs of individual septic tanks and disposal fields where the field or soil treatment area is only a short distance from the septic tank or the building itself. Consequently, in the determination of the optimum location for a central treatment plant, significant advantages can be gained if the overall service area is considered as a series of clusters or groupings of homes, each with its own localized collection and treatment system. This is especially applicable when soil absorption treatment systems are used, provided suitable soils can be found close to the source of sewage generation.

An alternative collection method receiving substantial attention is sewage pumping by the use of low pressure sewer systems. The two major types of pressure sewers are the grinder pump and the septic tank effluent pumping system. The former system employs individual grinder pumps to convey raw wastewater to the pressure sewer. In the latter system, only septic tank effluent (liquid portion of sewage) from individual households is pumped to the pressure main. The small diameter sewer system handles only the liquid portion of the waste, with the solids being accumulated and digested in a septic tank. This may result in lower costs of

materials, but the need for deep excavations and pumping stations is similar to conventional systems unless the effluent is disposed of close to the source.

Vacuum sewers depend on a central vacuum pump to create a differential pressure between the main and the sewage entering the main at atmospheric pressure. Both the vacuum and pressure systems may achieve significant reductions in material costs, pipe size, excavation costs, and in some cases, treatment costs. However, some increase in operating costs will also be experienced.

In summary, many of the significant cost elements of conventional central sewage collection systems can be overcome if the sewage can be disposed of close to the point where it is generated. The least costly method, and the one allowing the greatest flexibility in arrangement of the collection component, is likely to be through soil absorption of effluent.

## 4.2 TREATMENT

Currently, there is a fairly wide range of options available for wastewater treatment which can be broadly categorized into three types:

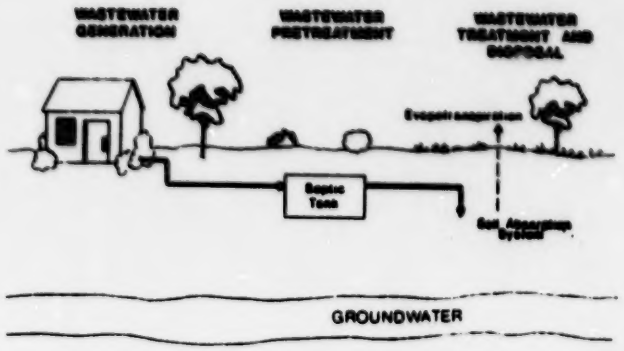
- centralized treatment prior to discharge into surface water;
- centralized treatment prior to disposal on land;
- decentralized treatment.

"Centralized treatment" refers to treatment in which wastewater is collected and transported to a central location where it is treated and/or discharged to either surface waters or land. Typical centralized treatment systems include mechanical and biological plants of various designs.

"Decentralized treatment" generally refers to those systems handling smaller amounts of wastewater at a given location. Typically, effluent disposal occurs in proximity to the sewage source eliminating the need for costly transmission of sewage to distant disposal sites. Disposal of effluent is usually to the soil and in some cases to surface water. A number of technologies are available which can provide decentralized treatment either on-site or at sites near the point of sewage generation.

The primary method of on-site treatment is the septic tank and soil absorption field.

The septic tank and soil absorption field has wide application in Nova Scotia in its traditional form, but several variations are possible to assist in overcoming site constraints and improving efficiency. These include dual alternating soil absorption systems, overflow systems on slopes, disinfection-discharge and mound systems.




AN ONSITE WASTEWATER MANAGEMENT SYSTEM.

Many of the systems mentioned under On-Site Treatment can be extended to include off-site treatment and disposal through clustering, or the sharing of common facilities amongst households within limited distances, in order to avoid the cost of long common collection systems. With the cluster systems, several houses are served by common treatment and disposal systems. Clusters of houses could also use other alternative systems, such as pressure and vacuum sewers and sewage treatment lagoons. Basic systems include:

- Cluster systems using common septic tank and soil disposal systems or sand filter systems.

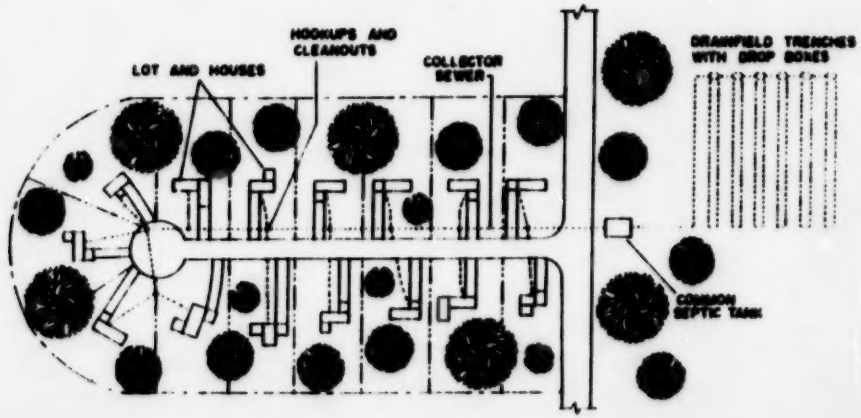
- Cluster systems using individual septic tanks and common soil disposal systems or sand filter systems.

- Cluster systems using common small scale lagoon with land application of treated effluent.

- Cluster systems using common small scale lagoon with seasonal discharge of treated effluent to surface waters.

- Cluster systems using package treatment plants with effluent discharge to surface waters.

A COLLECTOR SEWER SYSTEM WITH A COMMON SEPTIC TANK AND DISPOSAL FIELD



Although a range of technologies are available both off-site and on-site, no one system represents the optimum solution in all situations and, in fact, the optimum solution may be represented by various combinations of these systems.

A typical application could involve a small rural community with primarily low to medium density residential development. The residential development typically occurs along one main thoroughfare with a minor grouping of local commercial services. Cluster systems might be used to service the central portion of the community, combined with the upgrading of individual septic tank and soil absorption fields in the lower density peripheral areas.

# 5. COST IMPLICATIONS

The flexibility that the Wastewater Management District concept offers municipalities in terms of allowing them to select the most cost effective and environmentally acceptable wastewater disposal strategy for a given area also has definite advantages as far as costs are concerned. The primary cost advantage arises from the fact that the WMD legislation enables municipalities to utilize private disposal systems that are functioning properly, as part of the overall wastewater management strategy for a particular area. With future maintenance guaranteed, past investment in private systems (most of which would be on-site septic tank/disposal field systems) need not be lost.

Representative 1982 installation costs for three alternative wastewater disposal systems are shown in the following table:

| WASTEWATER DISPOSAL SYSTEM | 1982 COST PER CONNECTION |
|---|---|
| 1. Septic Tank/Disposal Field - Individual On-Site | $2,500 |
| 2. Septic Tank/Disposal Field - Cluster System | $6,000 |
| 3. Conventional Central System | $9,000 |

In order to better understand the cost implications of the WMD legislation on a community wide scale, consider the following hypothetical, yet realistic, example:

1. Community "A" consists of 130 homes.

2. Thirty of those homes have septic tank/disposal field systems which are functioning properly.

3. Of the remaining 100 homes, an engineering feasibility and design study recommended that 80 should be clustered into 4 common septic tank/disposal field systems and 20 should have existing private septic tank/disposal field systems replaced.

In 1982, a central sewerage system could have been installed in this community for approximately 1.17 million dollars (ie. $9,000 per connection x 130 connections). By creating a Wastewater Management District, the municipality could implement the strategy outlined above, at a cost of $530,000 calculated as follows:

| | |
|---|---|
| 20 homes x $2,500/home = | $ 50,000 |
| 80 homes x $6,000/home = | $480,000 |
| Total = | $530,000 |

The cost saving to the residents and the municipality ($640,000) is indeed substantial.

A detailed comparison of annual operating and maintenance costs is not possible in the context of this report. However, it is reasonable to assume that operating costs for the two options will not differ significantly.

In summary, by taking full advantage of the WMD legislation, a municipality could achieve considerable front-end cost savings in the area of wastewater disposal.

# 6. A PILOT PROJECT

The Wastewater Management District Concept has been implemented as a pilot project within the community of Port Maitland, Yarmouth County. The WMD within this community contains 120 households. Eighty-three dwellings have been grouped into 4 cluster systems, while the remaining 37 will be serviced by individual septic tank/disposal field systems.

The cluster systems became operational in May of 1983, and are being closely monitored in order to assess the long-term viability of the concept.

# 7. FURTHER INFORMATION AND ASSISTANCE

Further information and technical advice is available from the Departments of Health, Environment, and Municipal Affairs. Inquiries may be directed to:

N. S. Dept. of Health
Engineering Division
P. O. Box 488
Halifax
Nova Scotia
B3J 2R8

(902)424-4300

N. S. Dept. of Environment
Environmental Assessment Div.
P. O. Box 2107
Halifax
Nova Scotia
B3J 3B7

(902)424-5300

N. S. Dept. of Municipal Affairs
Community Planning Division
P. O. Box 216
Halifax
Nova Scotia
B3J 2M4

(902)424-7550

# APPENDIX

EXCERPT FROM MUNICIPAL ACT AS AMENDED JUNE 1982

203D(1) The council may by bylaw establish a wastewater management district if the establishment of the proposed district is approved by secret ballot at a public meeting by a majority of the persons assessed within the proposed district for real property tax and whose total real property assessment within the proposed district is at least fifty percent of the total real property assessment within the proposed district of all persons.

(1A) Notwithstanding subsection (1) and if the council so determines, the establishment of a wastewater management district may be approved by a plebiscite conducted pursuant to the Municipal Elections Act instead of at a public meeting.

(2) The Council may establish more than one wastewater management district.

(3) A bylaw made pursuant to subsection (1) shall:

(a) delineate the boundaries of the wastewater management district;
(b) state the system or systems of wastewater management to be used in the district;

(c) state the extent to which the municipality assumes responsibility for the repair, upgrading or replacement of private and public sewer systems; and

(d) provide a method for charging the persons assessed for real property tax within the district the expenditures made in the district for any wastewater management system.

(4) A bylaw made pursuant to subsection (1) may:

(a) provide that the charges for any wastewater management system are to be levied in respect of real property;

(i) in proportion to street frontage;

(ii) in proportion to real property assessment; or

(iii) in accordance with such other method as the bylaw may provide;

(b) make the charges collectable in the same manner as rates and taxes are collectable under the Assessment Act and, if the clerk so determines, collectable at the same time and by the same proceedings;

(c) make the charges a lien on real property in the same manner and with the same effect as rates and taxes under the Assessment Act;

(d) provide a manner for determining when such a lien becomes effective or when such charges become due and payable;

(e) provide that the charges with respect to a property may, at the option of the owner of the property, be paid in such manner as the bylaw provides and that on default of payment of any instalment the balance of the charges becomes immediately due and payable;

(f) provide that interest, at such rate and after such date as the bylaw provides, shall be payable annually on the unpaid balance, whether or not the owner has elected to pay by instalment.

(5) Where a council has made a bylaw pursuant to subsection (1), the municipality, its servants and agents may enter on any property within the wastewater management district to repair, upgrade or replace a private wastewater system and may, in accordance with the bylaw, charge any or all of the costs therefore to the owners of the property served by the system.